

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: § Serial No: unassigned  
Daniel T. Colbert et al. § (division of application  
§ Serial No. 10/000,746)  
For: MACROSCOPICALLY MANIPULABLE § Filed: concurrently herewith  
NANOSCALE DEVICES MADE FROM § Group Art Unit: 2881 (anticipated)  
NANOTUBE ASSEMBLIES §  
Atty Dkt: 11321-P011C1D1 § Prior Examiner: Jack I. Berman  
§ 703.308.4849

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**PRELIMINARY AMENDMENT ACCOMPANYING REQUEST FOR FILING  
DIVISIONAL APPLICATION UNDER 37 C.F.R. § 1.53(b)**

Sir:

This paper accompanies a Request for Filing Divisional Application Under 37 C.F.R. § 1.53(b) and associated filing fee therefor ("the Request"). If the fee payment is missing or insufficient in amount, or if any other fees are determined to be due, the Assistant Commissioner, Commissioner, and/or the Director of the U.S. Patent & Trademark Office is/are hereby authorized to charge any such fees (or credit any overpayment) to Winstead Sechrest & Minick Deposit Account No. 23-2426, referencing matter number 11321-P011C1D1.

## **AMENDMENTS**

### **In the Title**

Please amend the title by replacing the present title with the following:

--METHOD FOR PURIFICATION OF AS-PRODUCED SINGLE-WALL CARBON NANOTUBES--

### **In the Abstract**

Please amend the abstract by replacing the present abstract with the following:

--This invention relates generally to a single-wall carbon nanotube (SWNT) purification process and more particularly to a purification process that comprises heating the SWNT-containing felt under oxidizing conditions to remove the amorphous carbon deposits and other contaminating materials. In a preferred mode of this purification procedure, the felt is heated in an aqueous solution of an inorganic oxidant, such as nitric acid, a mixture of hydrogen peroxide and sulfuric acid, or a potassium permanganate. Preferably, SWNT-containing felts are refluxed in an aqueous solution of an oxidizing acid at a concentration high enough to etch away amorphous carbon deposits within a practical time frame, but not so high that the single-wall carbon nanotube material will be etched to a significant degree. When material having a high proportion of SWNT is purified, the preparation produced will be enriched in single-wall nanotubes, so that the SWNT are substantially free of other material.--

### **In the Specification**

Please amend the specification as noted on page 4, paragraph 11 of the Request by inserting before the first line of the specification the following:

--RELATED APPLICATIONS

This application is a division of co-pending prior application Serial No. 10/000,746, filed on November 30, 2001, which is a continuation of prior application Serial No. 09/242,040 filed on September 13, 1999, which is the 35 U.S.C. § 371 national application of International Application Number PCT/US97/13896 filed on August 8, 1997, which designated the United States, claiming priority to provisional U.S. patent application Serial Number 60/023,732 filed on August 8, 1996. Each of the foregoing applications is commonly assigned to the assignee of the present invention and is hereby incorporated herein by reference in its entirety.

This application discloses subject matter related to the subject matter of U.S. patent application Serial Number 09/380,545, filed on September 3, 1999 in the name of Richard E. Smalley et al., entitled "Carbon Fibers Formed From Single-Wall Carbon Nanotubes," which application is commonly assigned to the assignee of the present invention and hereby incorporated herein by reference in its entirety.--

**In the Claims**

Please amend the claims as follows.

Please cancel claims 1-83 without prejudice or disclaimer to the subject matter thereof.

Please add the following new claims 84-119:

84. (new) A method for purifying single-wall carbon nanotubes comprising:

- a) providing a mixture containing single-wall carbon nanotubes and at least one other reaction product formed in a method for producing single-wall carbon nanotubes;
- b) heating the mixture under oxidizing conditions; and
- c) recovering a purified product having a higher concentration of single wall carbon nanotubes than the mixture.

85. (new) The method of claim 84 wherein the oxidizing conditions provide for derivitization of at least one of the single-wall carbon nanotubes.

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86. (new) The method of claim 84 wherein the oxidizing conditions provide for esterification of at least one of the single-wall carbon nanotubes.

87. (new) The method of claim 84 further comprising reacting at least a portion of the at least one other reaction product to form a compound, wherein the compound is capable of being dissolved or suspended in an aqueous solution.

88. (new) The method of claim 84 wherein the purified product is suspended in a liquid.

89. (new) The method of claim 84 wherein the purified product is a solid product.

90. (new) The method of claim 89 wherein the solid product is recovered by a method selected from the group consisting of settling, filtration and combinations thereof.

91. (new) The method of claim 84 further comprising storing the purified product in water.

92. (new) The method of claim 89 wherein the solid product comprises a mat.

93. (new) The method of claim 92 wherein the mat comprises at least one material selected from the group consisting of ropes of single-wall carbon nanotubes, bundles of single-wall carbon nanotubes and combinations thereof.

94. (new) The method of claim 84 further comprising drying the purified product.

95. (new) The method of claim 94 wherein the drying is at about 850°C in a hydrogen gas atmosphere.

96. (new) The method of claim 88 wherein the purified product suspended in the liquid comprises at least 80% by weight single-wall carbon nanotubes.

97. (new) The method of claim 88 wherein the purified product suspended in the liquid comprises at least 90% by weight single-wall carbon nanotubes.

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98. (new) The method of claim 88 wherein the purified product suspended in the liquid comprises at least 95% by weight single-wall carbon nanotubes.

99. (new) The method of claim 88 wherein the purified product suspended in the liquid comprises at least 99% by weight single-wall carbon nanotubes.

100. (new) The method of claim 89 wherein the solid product comprises at least 80% by weight single-wall carbon nanotubes.

101. (new) The method of claim 89 wherein the solid product comprises at least 90% by weight single-wall carbon nanotubes.

102. (new) The method of claim 89 wherein the solid product comprises at least 95% by weight single-wall carbon nanotubes.

103. (new) The method of claim 89 wherein the solid product comprises at least 99% by weight single-wall carbon nanotubes.

104. (new) A method for purifying single-wall carbon nanotubes comprising:

- a) providing a mixture comprising single-wall carbon nanotubes, an amorphous carbon deposit and at least one other reaction product;
- b) heating the mixture under oxidizing conditions sufficient to oxidize the amorphous carbon and the at least one other reaction product; and
- c) recovering a purified product that comprises at least 80% by weight single-wall carbon nanotubes.

105. (new) The method of claim 104 wherein the oxidizing conditions are sufficient to remove at least a portion of the amorphous carbon deposit and at least portion of the at least one other reaction product.

106. (new) The method of claim 104 wherein the purified product is recovered by a method selected from the group consisting of settling, filtration and a combination thereof.

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107. (new) The method of claim 104 wherein the oxidizing conditions comprise heating the mixture in an aqueous solution of an inorganic oxidant.

108. (new) The method of claim 107 wherein the aqueous solution is heated to reflux.

109. (new) The method of claim 106 wherein the inorganic oxidant comprises a chemical selected from the group consisting of nitric acid, sulfuric acid, hydrogen peroxide, potassium permanganate and mixtures thereof.

110. (new) The method of claim 106 wherein the aqueous solution comprises nitric acid at a concentration between 2.0 and 2.6 Molar.

111. (new) The method of claim 104 further comprising removing at least one esterified amorphous carbon deposit, wherein the at least one esterified amorphous carbon deposit is formed under the oxidizing conditions.

112. (new) The method of claim 104 further comprising a saponification treatment of the mixture.

113. (new) The method of claim 112 wherein the saponification treatment comprises contacting the amorphous carbon deposit with a basic solution.

114. (new) The method of claim 112 wherein the saponification treatment further comprises sonication.

115. (new) The method of a claim 113 wherein the basic solution comprises sodium hydroxide.

116. (new) The method of claim 112 comprising neutralizing the mixture with an acid.

117. (new) The method of claim 116 wherein the acid is selected from the group consisting of hydrochloric acid, sulfuric acid, nitric acid and mixtures thereof.